Health, Safety and Wellbeing through Ethical Behaviours in Computer and Information Systems Development and Deployment

Harjinder Rahanu[1], Elli Georgiadou[1], Kerstin Siakas[2], Margaret Ross[3]

[1] Middlesex University, London, UK
[2] Alexander Technological Educational Institute, Thessaloniki, Greece
[3] Southampton Solent University, Southampton, UK

Abstract

Literature on systems development has been progressively identifying the importance of social aspects in systems development. However, there is often a failure of participants in the recognition, and fulfilment, of ethical duties concerning the concepts of health, safety and wellbeing. A rational appeal can be made to normative defensible ethical rules in order to arrive at a judicious, morally justifiable judgement. In this paper our first step is to report on the findings of a literature review, which presents the current health and safety issues concerning usage of computers in organisations and the workplace. Building on our earlier research basic generic Deontological and Teleological moral principles and theories we prescribe a set of moral rights and duties that must be exercised and fulfilled by stakeholders in systems development in order for them to exhibit moral behaviour. By identifying, and recommending a set of defensible moral obligations that must be fulfilled in the development and deployment of systems, protagonists such as: project managers, software engineering teams, systems analysts, and clients, can fulfil their ethical duties, thus increasing the likelihood a deployed systems that are compliant with principles of health, safety and wellbeing of its users.

Keywords: Normative Ethics, Health and Safety, Software Systems Development, Software Process Improvement

1.0 Introduction

When computer professionals begin work, they typically enter into relationships with one or several of the following: employers, clients, co-professionals (or the profession as a whole) and the public.[1] Literature reviews suggest that with regards to IS development and implementation projects, more often than not, the relationship between the professional and the client is predominant, which often invokes ethical and professional issues that can determine the success or failure of such projects.[2-6] Clients are heavily dependent on software and hardware suppliers for accurate, honest and open information, alongside sound and objective advice. This dependence creates special obligations for the vendor to be conscientious about advising clients.

Health, safety and the wellbeing of end users of the systems we develop as engineers are a problematic challenge for countless developers and organisations. Health and safety management is the process of identifying and minimising threats to workers and those affected by the work throughout the project, programme and portfolio life cycle. Health effects associated with the use of computer technology has important implications because of the prevalence of work with IT equipment in various forms.

Special implications for developers of systems and users of the deployed solutions are invoked and these are discussed in this paper. Most countries will have their own respective legislation governing health and safety in the workplace. In this paper the focus is on UK laws. However, it should also be noted that system developers, in turn, are, themselves, employees. Thus in their everyday working lives, they should also be entitled to work in environments that are conducive to good health and wellbeing.

Computer and Information Systems govern most of the human activity. Embedded systems are these days an integral part from the domestic appliances to transport systems as well as medical instruments. When such systems fail (and they do quite regularly) attention focuses on the technical aspect and components of these systems. In a globalised world and operations, for example in the aircraft industry (which has suffered a number of recent failures) it can be seen, for example, that Boeing[7] "has global reach which includes customers in approximately 150 countries and employees and operations in more than 65 countries. The company has manufacturing, service and technology partnerships with companies and governments worldwide and contracts with more than 20,000 diverse suppliers and partners". In these cases it is difficult to pinpoint the failing component (of either the product or the process) and to allocate responsibility.

Standards pay attention to technical quality characteristics such as reliability, usability, portability etc. However they very rarely deal with issues of health and safety. Deficient software systems in this respect are likely to in failures which often lead to significant financial losses but more importantly to damage and/or loss of human lives. Legal responsibilities may be attributed to the manufacturers and developers of such systems. However, legal aspects should be coupled with ethical and moral principles which are often overlooked.

It is this position paper that technical, ethical, moral and legal aspects of systems are explored. Building on our earlier research on basic generic Deontological and Teleological moral principles and theories we prescribe a set of moral rights and duties that must be exercised and fulfilled by stakeholders in systems development in order for them to exhibit professional moral behaviour.

2.0 Background

2.1 Software Process Improvement

Effective development and implementation of systems is the result of proper interplay between humans-centred aspects, specifically, socio-cultural aspects; and technology. Thus the study and optimisation of these should be conducted concurrently. There is a realisation in industry, commerce and government that the application of new software methodologies and technologies have failed to realise the desired gains in productivity and quality. There is recognition that the significant problem is the inability to manage the software process. There have been a significant amount of software process improvement efforts. Notable software process improvement standards and models from consulting firms include:

- The Capability Maturity Model Integration (CMMI), the replacement to the older CMM, developed at Carnegie Mellon University;[8]
- The International Standards Organisation's 9001 Specification (ISO 9001);[9]
- The ISO/IEC 15504 IT Process Assessment, aka Software Process Improvement and Capability Determination (SPICE);[10]

- Lean Six Sigma, the data driven leadership approach;[11-12]
- The 730-2014 IEEE Standard for Software Quality Assurance Processes, which establishes the requirements for initiating, planning, controlling, and executing the Software Quality Assurance processes of a software development or maintenance project.[13]

Central to each of these improvement models is the notion of a focused and sustained effort towards building a process infrastructure of effective software engineering and management practices. The Software Process Improvement (SPI) strategy aims for something that is more focused, more repeatable, and more reliable, with regards to the quality of the system developed (conformance to requirements, reliability, usability etc.), the timeliness of delivery and the expected cost. Also quality in use has implications on performance, reliability, and usability. Quality can also be understood in the context of SQuaRE (Software product Quality Requirements and Evaluation), a more extensive series of standards to replace ISO/IEC 9126.[14] ISO 25010 has a greater number of product quality characteristics and sub characteristics, in contrast to ISO 9126, including such aspects as effectiveness, efficiency, user satisfaction and societal impacts. The overall assumption is that a sound and improving process is likely to result in high quality systems i.e. process improvement is likely to result in improved products. However, if the organisational culture and practices allow for unethical behaviour SPI efforts are likely to fail.

2.2 Social Responsibility according to ISO 26000

ISO 26000:2010 is an ISO International Standard providing guidance regarding the integration of Social Responsibility (SR) into the practices of an organisation. It does not provide certification, similar to ISO 9001:2015, but organisations are encouraged to use it as a recommendation to be implemented in a voluntary manner. ISO 26000:2010, intended for use by all types of organisations and businesses, provides guidance on how they should operate in a socially responsible way (increasingly demanded by the society), meaning how they should be acting in an ethical and transparent way that contributes to the health and welfare of society.[15]

ISO 26000:2010 contains voluntary guidance (not requirements for a certification) regarding:

- concepts, terms and definitions related to social responsibility;
- the background, trends and characteristics of social responsibility;
- principles and practices relating to social responsibility;
- the core subjects and issues of social responsibility;
- integrating, implementing and promoting socially responsible behaviour throughout the organization and, through its policies and practices, within its sphere of influence;
- identifying and engaging with stakeholders; and
- communicating commitments, performance and other information related to social responsibility.

ISO 26000:2010 aims to support organisations for sustainable development. It goes beyond legal compliance and complements other instruments and initiatives for social responsibility. Legal, societal, cultural, political, environmental, economical, technological diversity should be taken into consideration when applying ISO26000:2010, while simultaneously being consistent with international norms of behaviour. The ISO 26000:2010 defines seven core subjects where each subject includes a range of issues related to SR as well as action suggestions. “Protecting consumers’ health and safety” and “Health and safety at work” are respectively included in the core subjects “Consumer Issues” and “Labour Practices”.

Zompras and Siakas[16] studied and evaluated social responsibility/sustainability reports of seven eminent corporate web-sites for identifying the SR themes that IT companies deal with and which core subject of ISO 26000, they primarily focus on. "Health and safety at work" is addressed by all seven companies, but only two companies address explicitly "Protecting consumers' health and safety" in their web-sites. This may impact on organisations, because recent news regarding products harmful to people's health, safety and well-being, have led consumers to become more aware about the organisations which they do business with and involve in. Consumers tend to reward companies that behave socially and ethically responsibly and punish companies that are irresponsible for their actions. Hence, the ethical consumerism has become a prominent feature of social life.[16]

2.3 Computer Ethics

It is generally recognised that law and morality do have in common certain key principles and obligations. Thus the law will clearly apply and lead directly to the appropriate ethical conclusion. However, to rely solely on law as a moral guideline is clearly dangerous because in certain circumstances bad laws exist.[17-18] Inadequate laws may bind rules on society that fail to provide moral guidance. Such laws may, in some instances, excuse a society from fulfilling certain obligations and duties, or allow a society to justify their unethical behaviour. Ethical judgments simply do not have the same deductivity and objectivity as scientific ones. However, moral judgments should be based upon rational moral principles and sound, carefully reasoned arguments. Normative claims are supported by: "*An appeal to defensible moral principles, which become manifest through rational discourse*".[18]

A normative claim can only be substantiated, and a rational discourse presented, through an appeal to such principles. Thus, with regards to the ethical issues raised by systems development and deployment, in Section 3 of this paper we will present a list of defensible ethical principles, which are taken from ethical theory. In Section 4 the authors identify the current issues concerning health and safety in the systems development and deployment process. Computerized information systems have brought with them new health and safety hazards, and these will be identified, alongside the issues pertaining to discrimination in the workplace. A number of heuristics are suggested in Section 5, which if followed may lead to ethical guidance concerning health and safety in the systems development and deployment lifecycle. These normative claims are substantiated via the citation of one or a number of the ethical principles from Section 3. Thus each heuristic is based upon rational moral and philosophical principles and sound, carefully reasoned arguments.

2.4 SPI Manifesto

The SPI Manifesto consists of three values and ten principles, which serves as an expression to state-of-the-art knowledge on SPI. In planning a SPI project, these values and principles can be embraced in order to better facilitate the necessary corresponding change in the organisation.[19]

The argument put forward in this paper that we, as SPI professionals, need to fulfil ethical duties concerning the health and safety, and the wellbeing, of end users of the developed and deployed systems correlates with the values outlined in the SPI manifesto. The SPI values: must involve people actively and affect their daily activities; is what you do to make business successful; and is inherently linked with change. The corresponding principles that are fleshed out, based on these three values, serve as foundations for action. The notion of health

and safety, and the wellbeing, is implied in the SPI Manifesto values and principles. However, we propose their explicit inclusion in the next update of the SPI Manifesto.

3.0 Defensible Ethical Principles

There are a range of ethical theories that have been developed throughout history and one or a combination of these can be selected. Fundamentally there are two basic approaches to ethics: *Teleological* theories (consider the consequences of an action as a measure of goodness) and *Deontological* theories (emphasise the rightness of an action above the goodness it produces). Rahanu et al.[20] presents a comprehensive list of normative principles sourced from ethical theory, which can serve as normative guidelines for addressing the moral issues, cases where ethical and professional issues may have been invoked. These principles have been sourced from ethical theories, including Teleological and Deontological ones.

Table 1 presents seven duties and ten rights (normative principles) that constitute the Deontological approach. Table 2 presents the three philosophies under the umbrella of Teleology. In addition to the Deontological and Teleological normative principles enumerated above, Rahanu et al.[20] lists further basic moral principles and theories including moral themes proposed by Huff et al.[21] that can serve as normative guidelines, which are presented in Table 3.

The appropriate and respective normative principles presented above will be applied to the moral dilemmas that are invoked by systems development and deployment by business process engineers, software engineering teams, process improvement managers, etc.

4.0 Health and Safety Considerations at Work

The principal UK legislation governing health and safety in the workplace, including the use of computers is the Management of Health and Safety at Work Regulations 1999. The Regulations were introduced to reinforce the Health and Safety at Work Act 1974. The MHSWR places duties on employers and employees including those who are clients, designers, principal contractors or other contractors.[22] Care must be taken that employees are not exposed to radiation from monitors. Provide adequate and appropriately designed equipment and furniture to minimise injury risk. Guidelines for creating and maintaining adequate working environments, including lighting and ventilation in offices, and the conditions under which computers are used, including the appropriate frequency and length of breaks for those working at computer terminals for long periods. To battle the problem of occupational injuries and diseases ISO developed the ISO 45001 standard: Occupational Health and Safety.[23] It stipulates requirements, which will help organisations reduce this burden by providing a framework to improve employee safety, reduce workplace risks and create better, safer working conditions, including the software/systems engineering industries.

Under the Equality Act 2010 disability is defined concisely and succinctly as “a physical or mental impairment that has a ‘substantial’ and ‘long-term’ negative effect on your ability to do normal daily activities”.[24] The term ‘substantial’ is more than minor or trivial, for example it takes much longer than it usually would to complete a daily task like getting dressed; and ‘long-term’ means twelve months or more, for example, a breathing condition that develops as a result of a lung infection. There are a range of disabilities, including visual, auditory, physical, speech, cognitive, language, learning, and neurological disabilities.

4.1 Computers and the Workplace

Sauter and Murphy[25] investigated the changing structure of work in our society and presents empirical research studies, which pointed to computerized information systems have brought with them new health and safety hazards. The authors argued that the computerisation of office work has resulted in increased levels of stress for workers. It was concluded that stress in the modern office, in particular where computerised monitoring and surveillance systems were implemented and utilised, could lead to, amongst other things: loss of job satisfaction; low morale; and absenteeism and poor employee-management relations. Duquenoy, et al.[26] postulate that increased interaction with computers, instead of people, has led to a: reduced sense of personal responsibility in the modern office; resulting sense of anonymity and depersonalisation can cause a lack of respect for an organisation and its resources; and diminished sense of ethics and values on the part of its employees.

Suparna and Bellis[27] argue that prolonged use of video display units (VDUs) can have a detrimental impact on users' health. Sustained use of computer monitors can result in a number of conditions, including eyestrain; double vision and headaches; and neck and shoulder problems. Bowley[28] concludes, on the basis of the findings of a multitude of research studies that excessive use of a computer keyboard, and other input devices, such as a mouse, can also lead to injuries to the arms, hands and fingers. This type of physical stress is commonly known as repetitive strain injury (RSI).

4.2 Discrimination at Work

Providing equal access to information systems for disabled groups is an important element of the implementation and management of IT systems in the workplace. These rights are enshrined in the law, primarily via the Human Rights Act, 1998 and Equality Act, 2010. The former states that individuals should not be discriminated against on "any ground such as sex, race, colour, language, religion, political or other opinion, national or social origin, association with a national minority, property, birth or other status".[29] The Equality Act places, upon an employer, the duty to make reasonable changes for disabled employees. These are known as 'reasonable adjustments'. Adjustments should be made to avoid an individual being put at a disadvantage compared to non-disabled people. The Equality Act 2010 also provides legal rights for disabled people regarding access to goods, services and facilities.

Cultural and language barriers may result in unconscious bias, misunderstandings, conflicts and project failures. Treating people unfairly at work because of their cultural, racial and sexual orientation difference may even be unlawful under equal opportunity laws. In todays' globalisation, organisations may span a variety of countries with different working cultures and different discrimination laws. Thus they must comply with national, European and international labour standards laid down by bodies such as the International Labour Organisation (ILO).[30]

Similarly gender discrimination continues to be an issue that is encountered by women in the workplace, such as sexual harassment and gender evaluation (the use of gender as a criterion for job-related decisions), which inevitable has negative impact on job-related outcomes.[31-32] Some of the forms of discrimination discussed previously could be the result of Unconscious Bias. The BCS, The Chartered Institute for IT, has introduced an Unconscious Bias Training course, for all employees and Volunteer Committee and Board members. This includes a series of case studies to generate self-awareness.[33] The Unconscious Bias Training course consists of an individual self-evaluation questionnaire, then working in small groups to

identify problems, possibly associated with ethical, health and safety issues or actions that could result in physical or mental strain as a result of unconscious bias or careless actions or decisions. Detailed case studies are examined, identifying the problems, risks and alternative solutions and their possible outcomes. An example of such a case study related to an older committee member that experienced problems in using a new group working system, resulting in the member become much stressed. Another case study considers the situation of a committee member that cannot attend the meetings due to deteriorating health, so having to use a wheel chair, as the lifts cannot be accessed in the evenings and there is a potential problem of evacuation in case of a fire. By considering these issues, the course attendees are encouraged to view various options, such as free meeting rooms with excellent technical facilities, but not suitable for those with disabilities. The BCS feels this unconscious training is important because our world has changed, so we must try to create an inclusive environment for all people, regardless of race, religion, gender, age and health, both mental and physical, by being aware of how we think and act so improving the "quality of our relationships, raising productivity and improving engagement to obtain better results" in addition to reducing the risk of litigation.

The BCS has now introduced the volunteer role of an Inclusion Officer for the committee of all Branches and Specialist groups. Part of this role is to consider the suitability for locations for committee and main members' meetings, such as access and parking for those with mobility problems, and suitable evacuation facilities, also guidance such as that can be given to speakers to assist deaf, partially deaf or blind attendees, including the possibility of technology to assist.

Case studies research carried out by Georgiadou et al.[34] revealed that women are either not participating in IT professions or when they participate they have minimal opportunities for career advancement. Such injustices are highly likely to result in process and systems failures which are detrimental to the individuals, the project, the organisation and society at large.

5.0 Heuristics

Following the investigations reported in the above sections of this paper we suggest the following seven heuristics, which if followed are expected to lead to ethical systems development and deployment guidance in the context of health and safety. Often there is a lack of relevant knowledge or inexperience of clients regarding health and safety and computers in the workplace. It is the computer professional's duty to instruct in such circumstances.

1 **Incorporate in the Design the Utilisation of Assistive Technologies**: as part of the system engineer's brief is to oversee the development and installation of new hardware and software. This must be completed within the framework of public interest. The British Computer Society Code of Conduct[35] demands that computer professionals "have due regard for public health, privacy, security and wellbeing of others and the environment"; "have due regard for the legitimate rights of Third Parties" (includes any person or organisation that might be affected by your activities in your professional capacity, irrespective of whether they are directly aware or involved in those activities); and "promote equal access to the benefits of IT and seek to promote the inclusion of all sectors in society wherever opportunities arise". This can be achieved through the incorporation of assistive technologies, for example, screen readers, refreshable braille display, eye gaze and head mouse systems, etc. In addition, the development of any web content

application must be compliant with Web Content Accessibility Guidelines (WCAG) 2.1, which defines how to make Web content more accessible to people with disabilities.[36]

2 **Ergonomic Design**: The development and installation of new systems must adhere to ergonomic design that looks to reduce strain, fatigue, and injuries by improving product design and workspace arrangement. The Health and Safety Executive[37] advocated measures that an employer must take, in order to protect their employees from any risks associated with Display Screen Equipment (DSE). These recommendations ensured compliance with the Health and Safety (Display Screen Equipment) Regulations 1992. Guidance ranges from how to effectively arrange a workstation, through to users modifying their body mechanics and employees adjusting their work patterns. There is a moral duty on systems developers to have due regard for public health, and wellbeing of others and the environment in which their developed solutions are installed. Thus there exists an imperative on computer professionals to install solutions that comply with health and safety guidelines and instruct where there is a lack of relevant knowledge or inexperience of ergonomics(product design and workspace arrangement) in others, for example clients, for whom systems are being delivered.

3 **Conduct an Operational Feasibility Study**: An operational feasibility study is the process of determining how a system will be accepted by people (assessing employee resistance to change, gaining managerial support for the system, providing sufficient motivation and training, and rationalising any conflicts with organisational norms and policies) and how well it will meet various system performance expectations (for example, response time for frequent online transactions, number of concurrent users it must support, reliability, and ease of use).[38] There is an ethical duty for health and safety to be assessed, as an integral part of an operational feasibility study. In the first instance the study should determine how the system will be accepted by people with specific disabilities. This may imply dialogue between developers and trade union, health and safety, and disability representatives. These representatives have rights under the management regulations to be consulted by their employers and developers about anything affecting members' health and safety, including the introduction and adoption of new technology. This may result in the negotiation of a policy for working with computers, akin to HSE guides. Secondly, there is a need interweave health and safety as part of the system performance expectations. For example, for every system a non-functional requirement that should be explicitly stated, thus contractual binding, should be the compliance with the Health and Safety (Display Screen Equipment) Regulations 1992.

4 **Formulation of a Computer-use Policy**: Organisations are continually being confronted with escalating liability with regards to employee use of electronic resources. In order to mitigate this risk of liability, companies need to develop and implement a computer-use policy, which explicitly outlines proper use of the organisation's electronic resources.[39] Employers that use monitoring technology face the possibility of creating an atmosphere of distrust in the workplace. An employee who feels no sense of trust from the employer lacks the incentive to be efficient and could be less productive. A balance needs to be struck between privacy needs with unrestricted control of computer usage, in other words, a point on the spectrum between the two extreme options of: do nothing or monitor everything. A computer-use policy must be formulated that explicitly states what the agreed behavior is regarding computer usage. The formulation process must

commence with a consultation with their legal counsel and other relevant parties (for example, human resources, employees, and, if applicable, union representatives) to determine what type and scope of policy would be best suited for the organisation. The system engineers overseeing the installation of new hardware and software (computer resources) have an ethical duty to participate and contribute to this formulation process of a computer usage policy. Their technical expertise, understanding of the current functionality of the delivered system, will give invaluable insight into systems capabilities, thus enabling far more effective, and better, policy to be drafted for enforcement.

5 **Formulate and Implement a Workplace Policy on Discrimination**: An employer has duty to protect the safety and welfare of your workers, ensuring that no one is unfairly discriminated against in the workplace. To do this, a workplace policy must be drafted and implemented.[40] The policy must include a plan to educate all project participants about discrimination and to encourage them to respect each other's differences. Any evidence or complaints of inappropriate behaviour must not be ignored but responded to. The response must be prompt and must ensure confidentiality. Project supervisors and managers must be trained on how to respond to discrimination in the workplace and ensure that the workplace policy is properly enforced. The policy must be reviewed regularly to ensure that its effectiveness is maintained.

6 **Conduct Ethical Retrospectives**: It is vitally important that participants/stakeholders in systems development and deployment are of a diverse representation. For example, there has been a considerable research comparing the approach to management, negotiation and innovation of males and females at the senior level. By utilising these possible differences and gender traits, an organisation could gain.[41] An important activity in the building of systems is conducting Retrospectives. This is a fundamental vehicle to discover, share, and pass along the learning from the system construction experience. Pivotal to holding ethical Retrospectives are certain ground rules, including: 1) Participants must respect and value alternative viewpoints and, seek, accept and offer honest criticisms of work; 2) Participants must be able to exercise freedom of expression. This will include the freedom to hold opinions and to receive and impart information and ideas without judgment and/or reprisal from others; 3) Exercise the right to anonymity; and 4) Invited participants engaging in Retrospectives must reflect a diverse representation. Failure to hold to these ground rules implies a neglect of ethical duties and possible organisational failures.

7 **Conduct Risk Management**: In order that risks are managed effectively and efficiently, the hazards and effects associated with the implementation of computer systems have to be properly managed. At its very core risk management can be viewed as four stages: 1) Identify - Are people, environment or assets exposed to potential harm? 2) Assess - What are the causes and resulting concerns? What is the probability in the loss of control? What is the risk? 3) Control - Can the cause be eliminated? What controls are needed and how effective are they? 4) Recover - Can the potential consequences or effects be mitigated? What recovery measures are needed? Are recovery capabilities suitable and sufficient? In other words the hazards and effects should be identified; fully assessed, necessary controls provided and recover preparation measures put in place to control any hazard release.[42] Thus, a risk management plan needs to be prepared, typically as a joint effort between project manager and system engineers, in order to document foreseen risks, estimate impacts, and define responses to issues. In order that

lessons are learned and Process Improvement is achieved a systematic recording and analysis of issues, errors, and failures must be carried out. In this all important process and document should be the health and safety concerns that have been identified above.

Table 4 presents each rule of thumb substantiated by citing one or a number of the ethical normative principles, listed in Section 3 above.

6.0 Raising Awareness and Training

In addition to the proposed heuristics this paper also suggests the following regarding the raising of awareness and training.

6.1 Social Responsibility Manager

To delivery ethical systems development and deployment in the context of health and safety it is vitally important that companies and organisations improve their Social Responsibility awareness. This paper argues that in a software engineering projects, project managers are duty bound to advocate and uphold the principles of health, safety and wellbeing for all affected parties. Thus in order to practice as a project manager there should be a prerequisite that those tasked with: tracking work to be completed; identifying any potential risks; setting deadlines and delegating tasks to members of the project team; etc. should be trained and certified in social responsibility. Associations such as the European Certification and Qualification Association (ECQA) have looked to address this. The ECQA has developed many job role-based qualification and skills, including the profession of the Social Responsibility Managers.[43-44] Thus there is an imperative that if the software engineering industry wants to improve social responsibility, including health, safety and wellbeing of fellow IT colleagues, the client, the profession and wider society that systems projects are mandatorily overseen by personnel that have the appropriate training and certification.

6.2 Training of Under and Post Graduate students

For a future generation of IT professionals to be sensitised to the social, legal and ethical effects of IT then it is vital that computer ethics be a part of any computer science education, and of membership of a professional organisation. It is by receiving such instruction that an IT professional can effectively engage with, and have an understanding of how computer applications affect, society. Inculcating of ethics is an integral part of making IT professionals socially responsible.

Most computer ethics courses in Higher Education include, in no particular order of importance, issues of privacy, autonomy, digital divide, democracy, informational freedom and quality of life.[45] "Health, safety and wellbeing" must be appended to this list, and any list of topics, that are on a computer ethics syllabus. A computer ethics curriculum must also include a set of skills needed to analyse and define social influences and responsibilities of an organisation. By doing so future IT professionals and software engineers can have the skills needed to define procedures that would ensure a grasp of the interest, often conflicting, between social responsibilities and economic interests of an organisation. One possible solution is to look at the ethical issues raised by computers and IT through the lens of a PESTEL (Political, Economic, Social, Technological, Environmental and Legal) analysis framework. Originally used by marketers to analyse and monitor the macro-environmental (external marketing environment) factors that have an impact on an organisation it could be

used to help in a SWOT analysis of the impact, and influence, of an organisation's IT on its external environment and vice versa.

7.0 Conclusion, Limitations and Future Work

The rationale of applying the ethical framework presented in this paper was to identify and defend ethical stances that can be taken in the concerns over health and safety regarding newly deployed and existing systems. In doing so, the authors conclude that the importance of ethical considerations in the developing and delivering health and safety compliant systems can be bought to the attention of the systems development and software engineering community: providers, project managers, developers, engineers and clients, thus help raise the visibility of ethical use.

The paper contributes to the current ethical and philosophical discourse relating to the health, safety and wellbeing in the use of computers in organisations. In particular, a set of heuristics for the ethical health and safety guidance has been proposed which will raise awareness of the moral issues and help guide developers and users of computer systems. The development of a set of heuristics presented this paper is an important one. For the majority of these suggested rules UK law clearly applies and leads directly to the appropriate ethical conclusion. But to rely solely on law as a moral guideline is clearly dangerous. There are instances where the relationship between law and ethics breaks down, and the law fails to provide moral guidance. Thus to solely rely on the law for guidance, to exclusively fulfil legal duties, may lead to occasions where an individual fails to accomplish their ethical responsibility.

The paper also advocates the importance of raising awareness and training regarding health, safety and wellbeing. In particular there should be mandatory training and certification in social responsibility of project managers, who oversee projects, Also there should be a mandatory requirement to have "health, safety and wellbeing" to be on a list of topics to be covered on a computer ethics syllabus taught in Higher Education.

The limitations of this study lie in the fact that at the moment our proposals need to be incorporated in policies at local, national and international levels which is a challenge. However, starting from bottom up applications of the principles and the guidelines further insights will be gained which in turn will strengthen the arguments for policy development and implementation. Additional research aims to interweave the issues of health and safety into the systems development life cycle (SDLC). Thus at each stage of the process for planning, creating, testing, and deploying an information system, systems developers will be conscious of the duty they have to incorporate health and safety into the system's specification and design. Further research in this field is needed relating to SME and micro companies where there are few if any computer professionals being employed, despite IT being a key component to the survival of the business.

The notions of health and safety, wellbeing and ethical duty need to be explicitly addressed in the SPI Manifesto. Although these are implied in the manifesto's three values and ten respective principles[46], there needs to be a much more unequivocal statement with regards to how these notions must govern personal behaviour in relation to Software Process Improvement work. Thus an eleventh principle could be appended to the SPI Manifesto: To Fulfil Ethical Duties.

The focus of this paper has been in the delivery of new systems that must be health and safety compliant for the recipient, the client.

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Table 1: The seven duties and ten rights (normative principles) that constitute the Deontological approach

Deontology	
Duty Based Ethics (Pluralism)	**Rights Based Ethics (Contractarianism)**
One ought to keep promises (*Fidelity*)	The right to know
..Right the wrongs that one has inflicted on others (*Reparation*)	..Privacy
..Distribute goods justly (*Justice*)	..Property
..Improve the lot of others with respect to virtue, intelligence, and happiness (*Beneficence*)	..Security
..Improve oneself with respect to virtue and intelligence (*Self-Improvement*)	..Political participation
..Exhibit gratitude when appropriate (*Gratitude*)	..Freedom of expression
..Avoid injury to others (*Non- Injury*)	..Freedom of association
	..Not to be discriminated against
	..Fair access to, and development of, communication resources
	..Protection of cultural identity

Table 2: The three normative principles that constitute the Teleological approach

Teleology	
Principle	**Definition**
Ethical Egoism	Moral agents ought to do what is in their own self-interest
Utilitarianism	Operating in the public interest rather than for personal benefit; maximises benefits over costs for all involved, everyone counting equal
Altruism	In benefit for others, even at a cost to yourself

Table 3: Further basic moral principles and theories that can serve as normative guidelines

Further Normative Principles	
Principle	**Commentary**
Principle of Autonomy	According to Immanuel Kant's moral philosophy, for an individual to be truly human, that person must be free to decide what is in his or her best interest.
Principle of Informed Consent	The Kantian approach affirms that someone has given agreement freely to something. For such an assent to have significance, it should be informed, that is, based on accurate information and an understanding of the issues at hand. If this information is deliberately withheld or is incomplete because of carelessness, then the consent is given under false pretences and is invalid
Golden Rule	*"What you do not want others to do to you, do not do to them.*"
The US Content Subcommittee of the Impact CS Steering Committee	Quality of Life; Use of Power; Risks and Reliability; Property Rights; Privacy; and Equity and Access[21]

Table 4: The seven heuristics morally substantiated via the citation of one or a number of the ethical normative principles

	Incorporate in the Design the Utilisation of Assistive Technologies	Ergonomic Design	Conduct an Operational Feasibility Study	Formulation of a Computer-use Policy	Formulate and Implement a Workplace Policy on Discrimination	Conduct Ethical Retrospectives	Conduct Risk Management
Justice	●						
Beneficence	●	●	●	●	●	●	●
Non- Injury	●	●	●	●	●	●	●
The right to Privacy				●			
The right to Property				●			
The right to Political participation						●	
The right to Freedom of Expression						●	
The right to not to be Discriminated Against	●				●	●	
The right to Fair Access to, and Development of, Communication Resources	●		●				
Utilitarianism	●	●	●				●
Altruism	●						
Principle of Informed Consent				●		●	
The US Content Subcommittee: Quality of Life	●	●	●	●	●		●
The US Content Subcommittee: Risks and Reliability		●		●			●
The US Content Subcommittee: Equity and Access	●		●		●	●	